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(See Bureau ltr. EN10/Rad Safe, P2-4, Ser. 05000, Dtd 21 Feb 47)

From: Chief, Bureau of Medicine and Surgery.
To: DISTRIBUTION LIST.

Subject: Safety regulations for work in Target Vessels formerly JTF-1.

Reference: (a) CNO Conf. ltr. Serial 021F602 dated 11 Jan 47.

(1) *all of paragraph remains* **UNCLASSIFIED**
The Bureau of Medicine and Surgery is charged with the responsibility of establishing safety regulations in matters involving radiological safety. (reference (a)).

2. In order that technical and scientific studies on target vessels formerly of Joint Task Force ONE may be conducted without endangering the health of personnel so involved, the safety regulations which follow are established.

3. If the safety regulations hereby established are observed, no personnel will be injured as a result of any form of radiological hazard which may be present on the target vessels.

4. RADIOLOGICAL HAZARDS.

(a) Two types of radiological hazard are recognized, i.e. "external radiation" and "internal radiation".

(b) If an individual stands in front of a powerful X-ray beam he is exposed to the hazard of external radiation.

(c) If an individual ingests radium or inhales radioactive dust he is exposed to the hazard of internal radiation.

(d) The internal radiation hazard is characterized by certain features not common to the external radiation hazard. Chief among these is the fact that the injurious material is in the form of a poison which produces damage only when taken into the body or applied directly to the skin. Throughout Operation Crossroads emphasis has been placed on the external radiation hazard. In dealing with the target vessels the internal

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Statement A

Approved for public release:

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radiation hazard will be emphasized inasmuch as it is the one of major importance at this time. It is subtle and best visualized on the one hand as being comparable to the hazard present in the mining of radioactive materials (inhalation) and on the other to that which was encountered in the painting of radium dials (ingestion). In extreme exposures, characteristic clinical findings may appear in a matter of days or weeks. In the less extreme exposures, it is likely that recognizable findings might not appear for many years. Even when the exposure is not of such an order as to cause death, it may cause tumors of various tissues which may be disabling. This subtle, lurking hazard requires respect.

5. PERSONNEL. It is necessary that the least number of persons consistent with the successful accomplishment of the program of study be permitted to board the target vessels or in any other way become exposed to their radioactivity. However, a sufficient number of personnel must be employed to assure that all individuals be exposed to the least possible degree. Not only is it necessary that the exposures of all individuals who board these vessels be reduced to a minimum of total accumulated exposure; but it is also desirable that this total exposure be appropriately interrupted in order to reduce the chance of injury. Sightseeing and other non-essential activities must be prohibited on these target vessels. Areas in which these vessels are moored should be restricted to official business only. Sentries or guards should be posted to prevent unauthorized persons from venturing too near. Only by neglect of the foregoing can these vessels constitute a health hazard within the area. Other areas, such as the "change house", radiologic safety laboratory, and areas for storage of radioactive materials should also be restricted to official business.

6. PRE-EXAMINATION. *all of paragraph 6 remains* **CONFIDENTIAL** All personnel, both military and civilian, who are to board these target vessels, and who may be exposed to radiation or radioactive hazard, will be required to have a complete physical examination prior to commencing such duty. Special medical records separate from the normal individuals health records will be set up and they will be classified as confidential, until declassification is permitted. These examinations will be conducted by specially trained representatives of the Bureau of Medicine and Surgery. Medical Officers will give particular attention to a history of skin sensitivity or of respiratory allergy.

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The condition of the teeth, tonsils, and skin will be carefully observed. It is necessary to eliminate from this work personnel who have chronic infections or chronic conditions of any nature particularly respiratory or skin infections, blood dyscrasias, fungus infection of the skin including scalp, pre-cancerous lesions, dry or cracked skin, warts or other lesions on the hands. In addition, all personnel must have sound vision and hearing. The required clinical laboratory examination will include, in addition to a complete blood examination, an erythrocyte sedimentation rate, an X-ray of the chest, and complete urinalysis. Beta counts will be made on the urine and when indicated other more extended radiochemical analyses will be carried out. The X-ray of the chest at this time is very important for future reference. It will be made on a full size film and filed with the "special medical record". The examinations must be completed before personnel may be given medical approval to board these vessels.

⑦ *all of paragraph 7(a), (b), (c) remaining*
FOLLOW-UP EXAMINATIONS. (a) ~~all personnel~~ **CONFIDENTIAL**
connected with work on target vessels will have regular monthly physical examinations. It is unlikely that evidence of over-exposure will be encountered, as overexposure will be impossible if safety regulations are adhered to. Examiners will pay particular attention to the hands to discover if present any radiation effects, such as reddening of skin around nails and excessive longitudinal corrugation and brittleness of the nails. Care will be observed in the interpretation of these changes. These medical observations will be used only as a screening method to select those who should be referred to the Medical Advisory Board for careful evaluation.

(b) At weekly intervals urinalysis should be performed in the case of each individual, including beta counts. When beta counts are twice the prevailing background or higher in any sample of urine, more extensive radiological tests will be done in addition to the beta counts. The urine will be carefully studied in case of accidental over-exposure to radioactive dust.

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(c) Complete blood counts and an erythrocyte sedimentation rate will be made at the time of the monthly examination, and at such other times as the Senior Radiological Medical Advisor may require. All blood samples should be obtained under similar technique and at the same time of day for each individual, in order to minimize effects of physiological variation in the composition of the blood. Since a variety of changes is possible in the blood picture after exposure to radiation, all blood counts will require in addition to very careful laboratory technique, interpretation by a Medical Officer trained in the special problems of radiological safety and in the hematology of radiation sickness. When indicated, and in cases suspected of over-exposure, or when unexplained laboratory findings occur, total erythrocyte and leukocyte counts should be made and the urine beta counts should be repeated. Individuals presenting these findings and individuals known to have received and over-exposure to external radiation as shown by photographic dosimetry should be removed from contact with possible exposure pending the outcome of these studies.

8. PROTECTION WHILE AT WORK.

(a) To insure that the workers are adequately protected, a definite procedure must be developed and rigidly followed. A "change house" or decontamination station must be established. In this house there will be provided a non-contaminated locker room where workers and others may remove their street clothes and enter a clean room where they receive a complete outfit of clean work clothing. They don their work clothing, stop at a check-in desk to receive their film badges, and proceed to work. The clothing should include a plastic helmet or "hard hat", a suite of cover-alls fastened to the neck, with sleeves rolled down, and with pockets removed or sewed up; canvas or rubber gloves, depending upon type of work; stout shoes or rubber boots covered by canvas "bootees"; underwear and sock shall also be provided; and a combat gas mask, rescue breathing apparatus, or positive pressure mask, depending on the work assigned. Each individual going aboard a target vessel will in addition be supplied with a pair of clean chipping goggles. Personally owned tools shall not

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be permitted to be used, but rather all necessary tools shall be Navy issue, and provided upon leaving the change house. No matches, lighters, cigarettes, or other smoking articles, chewing tobacco, gum or any edible material shall be carried while at work. Film badges will be worn on left breast of outer garment by all persons. It shall be the responsibility of the leader of each work party to make certain that no one is permitted aboard who has any wound on his hands or is otherwise disabled. Watches, jewelry, and other valuables should not be carried aboard the target vessel, principally because of the difficulty that would be experienced in decontaminating such articles.

(b) Upon completion of work the canvas booties and gloves of all personnel will be placed in a suitable container on the dock near the gangway for sinking at sea. After the removal of the gloves the film badges will be returned by each individual to the check-in desk. The men then enter the contaminated side of the "change house", where tools, masks, helmets, rubber boots and rubber gloves are returned for monitoring and decontamination. The remainder of the work clothing will then be removed. Clothing reading in excess of 0.1 R beta plus gamma per 24 hours will be collected and laundered separately. Other clothing is routinely laundered in the "change house" laundry.

(c) Handwashing facilities including brushes for scrubbing the nails will be provided which are separate from the showers. After gross dirt, and contamination if present, are removed from the hands by repeated scrubbing with soap and water, the workers will proceed to the shower and wash the body, repeatedly soaping and rinsing, pay particular attention to the hair and scalp. They will then dry themselves in the shower room, and re-enter the non-contaminated dressing room, where they will be completely monitored, with special attention to the hair, hands and soles of feet. A suitable hand counter will be required for monitoring the hands.

(d) *first sentence only -* Those whose skin still reads above twice background gamma plus beta, will return for a second shower. When each man's entire body has been sufficiently cleaned, he is permitted to dress in his street clothing.

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(e) It is pointed out that after such a "change house" has been in use for a relatively short time, the shower drains, laundry, etc. will become increasingly contaminated. It is suggested that, in order to avoid such contamination of the sewage system, that the "change house" and laundry be established aboard a barge or lighter as was done at Kwajalein. It is considered that the waste water may be allowed to drain into a harbor from such a floating "change house" with perfect safety. A lighter so equipped would have the further advantage in that it could be moored in the immediate vicinity of the target vessel for greater convenience to personnel.

all of (f) **CONFIDENTIAL**
(f) As a check on the hazard to which an individual may have been exposed, film badges will be worn by personnel at all times when they are aboard target vessels. These will be issued before the individual leaves the "change house" name and film badge number and date and hour recorded. Orderly reports are essential and will be kept. These will be delivered to the custody of the photographic dosimetry unit at the end of each working day. The badges will be processed the same night in the laboratories established for that purpose, and the individual permitted to reboard the vessel on the following day or days only if the tolerance limit of 0.1 R per 8 hour day has not been exceeded.

(g) Where practicable and when available, dosimeters of the pencil type, or those similar to a proteximeter, will be employed as a check on the photographic dosimetry coverage.

(h) Some form of visual identification should be employed to indicate particularly "hot" spots and lanes should be mapped out through the least "hot" areas. These lanes shall be monitored frequently and changed if radiological conditions warrant.

(i) The practice of souvenir hunting must be absolutely suppressed.

all of (j) **CONFIDENTIAL**
(j) Men will be warned to avoid pools of water on the deck since it is possible for contamination to occur when fission products are washed by rain from one part of the ship to another. Likewise attention must be paid to avoid dust clouds and piles of rust, paint scale, et cetera, which may give rise to a dust hazard or be tracked about. These are apt to be highly contaminated.

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(k) *all of (k)* Prior to working on each vessel, permission must be obtained from RadSafe, who will record in his official log that permission had been requested, was granted or denied. The name of the individual in charge of the boarding or working party will be recorded in the RadSafe Log prior to boarding. A monitor will always be in attendance with each working party. Ultimate and legal responsibility for safety of personnel rests with local Commander and he will be advised by Radiological Safety Officers and Medical Officers trained in radiological safety as to conditions. As in other situation, if the Medical Officer believes health is being risked, he will promptly report such an opinion to the Commanding Officer and to BuMed(RadSafe).

M-11 (1) While at work all personnel will remove no part of their clothing. While working below decks it is essential that the rescue breathing apparatus or positive pressure mask be worn, not only to prevent the inhalation of radioactive material but also in order to provide protection against noxious gases or lack of oxygen which may exist in the spaces which have been closed for some time. It is absolutely essential that personnel wearing the rescue breathing apparatus be carefully instructed in its use and in safety precautions pertaining thereto. Combat mask with ~~8-2~~ canister may be worn topside if conditions indicate (dust in air, vibration of ship, et cetera), and when Senior Medical Radiological Officer so advises on basis of BuMed requirements.

(2) It is not necessary to wear a protective mask topside while performing routine duties such as monitoring or inspecting, but the combat or assault mask with ~~8-2~~ canister should be carried at all times while topside of any target vessel. When some form of face mask is not worn, goggles to cover the eyes will be worn to prevent foreign bodies entering the eyes. This is to prevent as well the inevitable contamination when hands are employed to rub eyes. Positive pressure mask or rescue breathing apparatus will be required for any topside work that disturbs any surface, such as scraping, chipping, burning, welding or cutting. In using an air-line mask, care will be taken that no radioactive dust enters the intake side of the air supply pump. The medical Officer trained

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in radiological safety will assess the hazard in any unusual circumstances and will recommend the necessary safety precautions to be taken.

(n) There must be no eating, drinking or smoking while at work. Only when the personnel have been processed through the "change house" and completed their decontamination may they be permitted to smoke, eat or drink.

(o) Ships ventilation systems are not to be operated except as approved by RadSafe and medical Officer jointly; nor will portable blowers be used without such clearance. Extreme care must be taken in handling compressed air lines to avoid spreading contaminated dust by the air stream from a leaking or parted line. Dust samples using the "filter queen" or other suitable sampling device should be taken in a number of areas throughout the ship prior to extensive operations. Interpretations of this hazard will be made by radiological medical officer on basis of information obtained from radiological and toxicological survey of the ship and in accordance with BuMed instruction to Medical Officers. Where necessary the assistance of the Medical Advisory Board (San Francisco) will be sought. *this part* - ~~CONFIDENTIAL~~

(p) Dry sweeping aboard target vessels will not be done. This will not apply to small localized operation of collecting dust samples for analysis. If it is necessary to clean a space this can be done by swabbing or perhaps flushing down. Swabs will not be wrung out by hand but may hung to dry on the life lines.

(q) All workers shall be instructed that in the event of damage to his clothing, gloves or other protective equipment he shall leave the target vessel immediately.

(r) Personnel sustaining an abrasion or open wound will immediately wash same with soap and clean water and will return to the "change house", and from there be sent to the Dispensary for appropriate treatment and will be accompanied by

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the Radiological Medical Officer or his representative. In order to provide means for washing hands, water and soap will be stored in each target vessel to be available for such first aid, or medical attention, as may be required. The formalities of decontamination will be deferred until such time as it can be carried out without jeopardizing the general welfare of the individual.

(s) Handling of objects must be kept to a minimum. Cotton gloves give some protection against contamination of hands and should be worn at all times when aboard target vessels. It must be remembered that distance is the best protection against external radiation.

(t) The use of the rotary wire brush is specifically forbidden as being too dangerous in all respects.

(u) ^{all} ~~CONFIDENTIAL~~ All articles removed from the target ships for official purposes will be segregated in a clear non-contaminated area. They will be marked for identification, record made of pertinent data and logged in central laboratory files. It is necessary that a central control be exercised over all material or objects taken from the target vessels. Suitable "RADIOACTIVE WARNING" signs will be attached. Such articles will not be accumulated in large stock piles. Highly radioactive materials so removed will be handled by the least possible number of persons and in such a manner as to produce the least exposure to radiation. If it is desired to ship any of these radioactive materials, they must be packaged properly so as to avoid accidental exposure, to prevent fogging of film in shipment, and to comply with all governmental and other regulations for shipment.

(v) ^{all} ~~CONFIDENTIAL~~ Vehicles used for transporting radioactive material should also be carefully monitored; the use of wooden-bed trucks and passenger vehicles should be avoided. Truck beds, carts and other carriers may be covered with a tarpaulin or canvas before receiving material from the target ships. These protective covers may be re-used until contamination of the truck or carrier is threatened, at which time the protective covers will

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be disposed of by sinking at sea. Capes Gas Protective (CWS, US Army) are suitable substitutes for tarpaulins and can be collected for safe disposal at sea, after a single use. Likewise, surfaces of small boats which may be used in connection with work on the target vessels should also be monitored and decontaminated as necessary, in accordance with instructions issued in connection with clearance of non-target vessels.

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(w) *all* - **CONFIDENTIAL**
Should it be desired to dry-dock the target vessels, the utmost care must be taken in order that working and other personnel be not exposed to excessive radiation nor that the dry-dock itself be contaminated. Contaminated debris must be carefully collected and disposed of by dumping at sea beyond the ten mile limit or 100 fathom curve. The dock must be washed down continuously during such operations. Sand blasting must be done by the wet method. Sand and debris must be collected and dumped at sea.

(x) *all* - **CONFIDENTIAL**
Acid baths or other waste solutions used in cleaning salt water systems or decontaminating other materials must be carefully monitored and the contaminated waste dumped at sea. All machinery and equipment including hand tools used in working on these target vessels should be monitored and decontaminated when this is possible. When they cannot be rendered safe by decontamination, they will be properly safeguarded or disposed of at sea as may be necessary.

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9. NON-RADIOLOGICAL HAZARDS.

(a) While exposure to radioactivity must always be regarded as the chief hazard in working on the Bikini Target Vessels, it must nevertheless be remembered that other hazards peculiar to damaged ships will exist at the same time. It is not desired at this time to make extensive reference to precautions to be used against noxious gases, lack of oxygen, explosive hazards, etc., as this has been adequately and extensively covered elsewhere and is a doctrine with which nearly all naval personnel are more or less familiar. Precautions outlined in CJTF-1 Op Plan 1-46 are still valid and Commanding Officers will see that the

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intent of same is complied with. It is, however, pointed out that these vessels will have completed a long trip from Kwajalein, their compartments will have been closed for long periods of time, and it will be considered dangerous to enter such compartments without adequate test procedure. Tests first should be made in the usual manner for explosive hazards, then for the presence of adequate amounts of oxygen, and finally for toxic gases and vapors. Compartments in which such hazards are discovered shall be thoroughly ventilated prior to entry, care being taken to avoid spreading radioactive contamination by the process of ventilation. In ventilating a space, the primary concern must be to avoid stirring up dust. The ships ventilation systems shall not be used to accomplish needed ventilation, nor shall vent sets or fan motors be started for test purposes. If natural ventilation is insufficient to provide the required air-change portable blowers may be rigged. Portable blowers, both exhaust and supply, should be operated so as to produce the lowest air velocities necessary to change the air in the compartment. In any event personnel will go below only when properly protected by adequate positive pressure mask or rescue breathing apparatus and when working in pairs, one below and one topside. While the blowers are operating all hands shall be ordered off and away from the ship, or shall wear the rescue breathing apparatus or positive pressure mask.

(b) Portable diesel sets or other power equipment shall not be so placed on deck that its vibration may cause dust to fall in adjacent spaces below, or produce a dust hazard topside.

(c) Another type of hazard which will be found peculiar to damaged target ships is that due to structural damage of various kinds. Personnel should be on their guard constantly against falling material from structure which has been further weakened by the long trip from Kwajalein. Loose material may give way when a little additional weight is placed upon it. Ladders, decks, grating, and similar structures may fail under foot. Round objects or sliding materials may be present on deck causing insecure footing. Decks may be slippery due to water or oil. It must be realized that spaces below will be very dark and the possibility of striking the head against hanging structures such as beams,

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ventilation duct work, etc., is a very real one. It will be particularly desirable to provide adequate indoctrination and supervision in general safety measures for technical or other personnel not familiar with ship-board hazards.

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GENERAL. (a) If possible, target vessels should be moored in such locations that prevailing winds will not carry contaminated dust, spray, or other materials toward any inhabited area or roadway. It must be carefully determined before each dust producing operation is begun, that no injury to persons nor contamination of property can result.

(b) Since a fire in a target vessel would be fraught with serious consequences, every precaution will be taken to prevent fire. Cutting, burning, and welding should be kept to a minimum and then done only by properly protected qualified personnel when adequate fire fighting equipment is immediately at hand. Adjacent spaces should be examined to make sure that inflammable materials are not stored against the other side of bulkheads subjected to heat.

(c) Working parties will make certain that no one is left aboard locked in a compartment prior to leaving the ship.

(d) Diving operations may be conducted as necessary. Divers shall be processed through the "change house" like all other personnel. They will wear on their person besides film badges, pencil electrometer dosimeters. There must be no open wound on their hands. The air supply of the diving gear must be located so as to avoid the intake of air contaminated with radioactive dust. Upon surfacing, divers shall be monitored and required to proceed through the "change house" in the usual manner. Their diving dress shall be monitored and decontaminated if necessary.

(e) "Overhead" personnel, that is, those whose tasks are the care of the "change house", the laundry, or any other duty which requires contact with contaminated material shall be provided with film badges, monitored and decontaminated just as if working on the target vessels. The "change house" and laundry themselves as well as the radiological safety laboratory shall be routinely monitored, and decontaminated when necessary, proper records being kept of these procedures.

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(f) All persons other than military personnel and civil service employees who are permitted to board any target vessel shall be allowed to do so only after signing a statement that they go aboard at their own risk. Compliance with all safety regulations shall be required of such individuals during their visit.

(g) In order that all hands may be properly informed as to the hazards and as to the safety measures to be observed, it is necessary that organized indoctrination be provided. It is particularly important that those in immediate charge of working parties be cognizant of their specific responsibilities in regard to the supervision and execution of safety measures.

(h) It is recognized that personnel working in these target vessels under these exacting safety precautions may in time go "stale". In order to provide a means for general discussion as well as for briefing and familiarization in hazards and safety procedures and to keep all hands up to date in these respects, it is suggested that a weekly meeting be held. It is felt that such meetings will be genuinely helpful to morale. By this and other means addressees where applicable, shall disseminate such information as is required to insure that all personnel concerned are thoroughly familiar with all safety precautions. It is again emphasized that the dangers presented by the target vessels are real ones and that radioactive contamination encountered will be too heavy to be treated casually as may have been done at times in connection with the decontamination of non-target vessels.

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Chief, Bureau of Medicine and Surgery.

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